tance. The medical officer may be appealed to for expert advice as to this question and unless forewarned and prepared may be at a loss to give accurate and concise information to commanding officers.

The question of water supply on the march resolves itself into two parts: How much water can the body afford to lose? When and how often must this water be replaced? A man weighing one hundred and fifty pounds contains in his tissues about one hundred pounds of water. He cannot lose more than one-tenth of this, ten pounds or one gallon, without running serious risk of death. If he is in good training he can perhaps at the outside afford to lose seven and five-tenths pounds or six pints without intolerable suffering and loss of efficiency. If in poor training a loss of two and five-tenths pounds or two pints will probably produce both of these.

How much water will he lose in a march over a given distance? In a march of one mile over ordinary roads in heavy marching order the actual exertion demanded is about ninety gram calories. If the heat thus produced is to be dissipated by evaporation then for every mile 180 c.c. of water must be got rid of. In one hour's march, say three miles, allowing for ten minutes' halt, he will have lost a 540 c.c. or almost one pint. For the first mile, however, the heat produced will be utilized in raising his body temperature to the optimum for exercise, in common parlance "getting warmed up." Heat regulation will not therefore come into play until this distance has been covered. At the end of the first four miles he will have lost one pint, at the end of the seven miles he will have lost two pints, the limit of permissible loss for the partially trained soldier. In his case then it will be seen that he should be able to march seven miles, half of an ordinary day's march, without drinking. At the half-way halt he must have his first drink and after that regularly every hour of the march one pint of water. His water bottle contains a little less than two pints, so that having marched seven miles without drinking he should have a little less than a pint at the half-way halt, and the rest at the end of ten miles, after which he should be able to get home without further supply.

Suppose, however, that the soldier is in the best possible physical condition and able to endure the maximum permissible loss, six pints, he can therefore cover six times three miles, in addition to the preliminary one mile, without drinking, a total of nineteen miles. So it is safe to say that every soldier should be in condition to cover an ordinary day's march of fourteen miles without resource to his water can, if the roads be ordinarily good.

If the march be prolonged, up to twenty-five miles say, every man must have his pint or thereabouts every hour after his limit of endurance has been reached, whatever his original permissible limit of loss might be. In well disciplined organizations these results are attained by never allowing men to drink except at the word of command.

When wars are over and the demobilization of troops takes place many important duties devolve upon the Medical Department. One of the most important of these is the supervision of troops returning from the war zone to insure against contagion being carried therefrom to the civil population at home.

Disabled soldiers must be cared for and in many cases reeducated to make themselves self-supporting in some form of industry.

Matters of interest and value for compiling the medical history of the war must be gathered together and individual records of sickness and injury gone over to adjudicate pension claims.

The title of this paper, as you will note, includes many activities of the Medical Department in war that are not touched upon this afternoon. Most of these omissions are of topics taken up by others in past or coming papers.

IS ACUTE ANTERIOR POLIOMYELITIS SPREAD BY DIRECT PERSONAL CONTACT?

REPORT OF AN INTERESTING INCIDENT.

By J. C. GEIGER, M. D.,
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In accordance with the long-established policy of the California State Board of Health to investigate intensively cases of acute anterior poliomyelitis, an investigation of two cases occurring in children living in Mill Valley, Marin County, California, was recently carried out. The records of the cases with the important data collected, mainly from the viewpoint of contagiousness through contact, should prove of interest to all students of the epidemiology of the disease.

Case No. 1. Name, M. P., age 4½ years. Dr. O. P. Stowe, physician in charge.

The history of the case is as follows: On Monday, November 27, this child was ill. There was some nausea and vomiting followed by restlessness that night. On Tuesday, November 28, the child was considerably better. On the morning of Wednesday, November 29, there was a return of the nausea and vomiting. There was some diarrhea. Temperature was evident. With some improvement of the general condition the child was allowed to attend a dancing school party that same afternoon in Mill Valley. On November 30 the patient was first seen by Dr. Stowe, mainly because of restlessness the night before and temperature which had been present. Dr. Stowe informed me that the child was nauseated, with some vomiting during Thursday. All physical signs with special reference to paralysis were negative. When seen again on Friday, December 1, the vomiting had ceased but a paralysis was noted of one-half of the tongue; the tongue being directed somewhat to

the left. There was also paralysis of the right side of the face. In the evening the paralysis of the right eyelid and side of face was very marked. There was no pain. In a telephone consultation with another physician living in San Francisco, the physicians agreed that there was some central involvement, but both were inclined to favor a diagnosis of tubercular meningitis. On Saturday, December 2, there was a paralysis of the left arm with much pain on movement. The child complained of pain when the tongue was handled and extended. The urine was negative. The throat was clear but the tonsils and the pharynx were exceedingly red. Temperature had ranged from 101 to 103.5. Dr. Stowe was advised to bring the child to San Francisco. He accordingly telephoned to St. Luke's Hospital for permission to enter the child there, and this being given, a late morning boat was taken. While on the way to San Francisco the patient asked for a glass of water. On attempting to drink some of the fluid, swallowing was evidently difficult and accompanied by much pain. There was considerable mucous flowing from the nose and mouth, the mucous being thick and ropy. Breathing at times was labored and hard.

At a consultation at St. Luke's Hospital, a diagnosis of acute anterior poliomyelitis was made. The child died at 5 o'clock that afternoon following a series of convulsions.

An autopsy was performed by Dr. G. Y. Rusk, Associate Professor, Department of Pathology, University of California. Frozen sections of the spinal cord taken through both enlargements and sections of the cord, medulla, and cortex fixed in alcohol and run through acetone showed in the cord characteristic alterations of anterior poliomyelitis. The same was shown in the medulla and in the cortical sections examined. There was a moderate infiltration also in a few perivascular spaces with exudate similar to that in the meninges.

Case No. 2. Name, J. C., age 2 years. On December 17 the baby was noticed to be ill. There was some fever but no nausea. There was some diarrhoea. The patient was very restless. She was seen by a physician on Deecmber 19 and 20. On the 19th it was noticed that the patient could not use the right arm. There seemed to be some pain and rigidity in the back of the neck. Dr. O. P. Stowe saw the child on December 21. There was some enlargement of the submaxillary glands but no pain on pressure. The throat was rather red. The baby would cry on handling and paralysis on the left side of the face and eyelid was plainly evident. The right arm could not be lifted and it was noted that the patient could not rest any weight on this arm. When seen on December 23, the paralysis of the left side of the face was plainly evident. There was some distinct involvement of the right arm, but as Dr. Stowe informed me not to such an extent as when he saw it two days before. The temperature was 99.5 by rectum and there was an exaggerated knee jerk on the right side. The parents informed me that the child was very much improved.

EPIDEMIOLOGY.

In going over the history of Case No. 1 it was ascertained that she was known to have been to San Francisco on a shopping tour with her mother a week or ten days previous to the illness. There was also a history of having played with a number of children in the playground of a large department store in San Francisco. There had been two social parties in Mill Valley to which this child had attended. There was one November 11 which was attended by a large majority of the citizens and children of Mill Valley and its vicinity. The second party, a dancing school, was attended by this child on the afternoon of the day on which she showed definite symptoms of acute anterior poliomyelitis. Various comments were made upon the paleness of the child and how badly she looked. Under these circumstances the child was handled and fondled more than usual by those present. In the party there were sixty-six other children, ranging in age from 2 to 14 years, fifty-six of whom were under 10 years and sixteen under 5. There is a distinct and definite history of this child having played with the majority, having danced with many and in some instances being kissed and fondled by the children present. There was no doubt that some used the same utensils, drinking glass, etc., along with this child. The room was not over 20 by 30 feet and there seemed to be an unusual crowd present.

Further investigation proved that in addition to the contact at the party a number of children visited the child at home and there played with her. No cases of acute anterior poliomyelitis had occurred in Mill Valley for several years, so undoubtedly this exposure constituted the first for many children present.

Accompanied by the Health Officer and Dr. Stowe each individual family was seen, the circumstances and symptom complex of the disease explained to them and their child or children placed into quarantine as contacts for a period of twenty days, according to the regulations of the California State Board of Health. One of these children came from Berkeley, two from San Francisco, and one from Sausalito. Every child known to be at the party was placed into quarantine as contacts accordingly, but the adults were allowed their freedom in every respect. In addition a letter sent to every family summarizing the above verbal instructions.

Case No. 2 was naturally exceedingly interesting because of the previous case that had occurred in Mill Valley. This family was of an entirely different social strata from the other case. They did not know the family in which the first case had occurred. They lived at least a mile to three-quarters of a mile apart. The water supply was the same as supplied to the city of Mill Valley. The mother does her own laundry on the premises. The milk supply was not in common. The contacts to the other case were not out of quarantine when this case came down.

These two cases are an interesting contrast; different social strata; no known knowledge of

each other; no possible contact with each other; no food supply in common, except water, which is the general supply, and no possible contact of the second case with the contacts of the first case. Flies can only be considered a negligible factor as they are not present at this period of the year.

Mill Valley was visited on different occasions during the period of quarantine and there was not one recorded instance in which the regulations put in force were violated. All the children remained remarkably well. The quarantine of the contacts of Case No. 1 was terminated on December 23, 1916, and there have been no further cases reported.

CONCLUSION.

Therefore taking everything into consideration relative to the sixty-six close contacts of Case No. 1, particularly their supposed susceptible ages with the subsequent negative clinical results and especially since, for the majority, it undoubtedly constituted a first exposure to the disease, there seems to be sufficient reason to doubt the accepted present-day theory of the spread of acute anterior poliomyelitis by direct personal contact.

THE FALLACY OF POST-VACCINATION TETANUS DUE TO VACCINE VIRUS.

By J. C. GEIGER, M. D.,
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In a study of cases of tetanus following vaccination against smallpox, Elgin[1] plainly points out that tetanus is the most important complication of vaccination, and largely preventable. An investigation of a case of post-vaccination tetanus recently occurring in San Francisco should add emphasis to the need and importance of follow-up care in vaccinated persons.

The History of the Case: Name, E. C., age 6 years 10 months. San Francisco, Cal. Dr. N., physician in charge.

The child was vaccinated according to what is known as the cross-scarification method on July 23, 1916, by Dr. N. Dr. N. informed me that the arm was sterilized first by washing with soap and water, then with a weak solution of bichloride with the later use of alcohol and further cleansing of it by sterile water. This was the primary vaccination of the child. A vaccination shield was used over the fresh wound. This was then covered by a sterile bandage. The child was requested to come back for observation in five days. The reason for vaccination as given by Dr. N. and also by the parents was that the child intended to enter school at the beginning of the fall term, somewhere near July 28.

Result and Character of Vaccination: The patient was not seen again until two weeks after vaccination. There was no scab. The underclothes were adherent to the wound. Some parts of the original dressing, partly on and off, remained. This was very dirty and soiled. There was not much pus present. The area of inflammation around the wound was as large as a silver dollar. The wound was freshly cleansed and sterile dressings applied.

Date of Onset of Symptoms of Tetanus and Summary of Symptoms: When seen again, August 12, the arm was very much inflamed. The wound was again cleansed and sterile dressings applied. The parents were requested to bring the child back the following day. She was not seen until the evening of August 13. At this time there was some stiffness of the vaccinated arm as well as rigidity of the muscles of the neck. The temperature was 101 F. by mouth. It was impossible for the child to open its mouth even after urging. She was then sent to the French Hospital and the records of the hospital show she was admitted on the evening of August 13, 1916. That same evening, 3000 units of tetanus antitoxin was administered subcutaneously. This dose was repeated on the morning of August 14. Three thousand units of anti-toxin was administered on the evening of the same day and again repeated four hours later. The highest temperature recorded was 101.8 by rectum. Then the pulse ratio was 132, respiration 30. Other palliative treatment was used during the course of the disease. The child died early on the morning of August 15. The symptoms of the case were typical and a diagnosis of tetanus was justified.

Vaccine Virus: Dr. N. informed me that there had been vaccinated approximately fifteen to twenty other persons along with this child, including the sister of the patient. There was no history of illness of any kind whatever in those vaccinated except in the case under discussion. The same vaccine virus was used in all cases as far as the physician knew. A sample of the virus used in the vaccination of this child was obtained. Investigation of the laboratory records at the time of manufacture showed the vaccine to be free of contamination with tetanus. Thirty-three thousand five hundred and eighty vaccine points of this particular set of virus were shipped for distribution.

DISCUSSION.

The father of the patient works in a South San Francisco packing company as a fireman in the engine room. From the mother it was learned that the child was playing freely the day before the onset of the symptoms of tetanus, August 13. Pain in the neck was the first symptom noticed. There was a stable across the street from this house in which horses were kept. There was some manure scattered about the yard. The boy of the family in whose yard the stable was located played with the child quite often. There is a fairly reliable record of this child playing in the stable yard. As far as it could be learned, though not definitely ascertained, the scab was removed or knocked off of the wound two or three days before she became ill.

From the records of the French Hospital as well as personal communication from Dr. N. and the parents the onset of symptoms of tetanus in